PREPARATION OF COATED ABRASIVE DISK

FIELD OF THE INVENTION

The present invention relates to a method for preparing a coated abrasive disk having an improved dimensional stability and high breaking strength.

BACKGROUND OF THE INVENTION

Conventional coated abrasive disks comprising a vulcanized fiber substrate shown in FIG. 1 are prepared by coating an adhesive resin on the vulcanized fiber substrate to form a first adhesive layer, spreading a layer of an abrasive material thereon, pre-drying, coating the abrasive layer with a second layer of an adhesive resin and drying the coated layer.

Such a method to form directly on a substrate an abrasive body comprised of a first adhesive layer, an abrasive material layer and a second adhesive layer, however, has a problem in that the shape of the substrate may become distorted by heat during the drying process of the abrasive layer, resulting in a poor product quality. In addition, this method requires a post-treatment, i.e., humidification, step to impart dimensional stability to the final abrasive disk.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide a simple method for preparing a coated abrasive disk that obviates a

humidification treatment of the final product; and a coated abrasive disk prepared by said method, which has an improved dimensional stability, high elasticity and high breaking strength.

In accordance with the present invention, there are provided a method for preparing a coated abrasive disk which comprises preparing a disk form of a supporting substrate; preparing a disk form of a coated abrasive body comprised of a backsheet and a layer of an abrasive material thereon; and combining the supporting substrate and the coated abrasive body such that the backsheet of the coated abrasive body is bonded to the substrate by using an adhesive; and a coated abrasive disk which has a structure comprising a supporting substrate, an adhesive layer, a backsheet and a coated abrasive layer which are sequentially stacked.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and features of the present invention will become apparent from the following description of the invention, when taken in conjunction with the accompanying drawings, which respectively show:

FIG. 1: a schematic diagram of a conventional coated abrasive disk;

FIG. 2: a schematic diagram of a coated abrasive disk in accordance with the present invention;

FIG. 3: a schematic diagram of a roll coater for coating an adhesive on a substrate; and

FIG. 4: a longitudinal cross-sectional view of a textile layer composed of a laminate of glass and carbon fiber textiles.

DETAILED DESCRIPTION OF THE INVENTION

The inventive method for preparing a coated abrasive disk employs a laminating technique of binding a coated abrasive body comprised of a backsheet and a coated abrasive layer to a supporting substrate; and the resulting coated abrasive disk is further illustrated in FIG. 2.

The supporting substrates which may be employed in the present invention include engineering plastics, bakelite (cotton fibers impregnation-treated with a phenol resin) plates, and a laminate of a nonwoven fabric and at least one textile selected from the group consisting of glass fiber, carbon fiber, polyester and nylon textile, which are commercially available.

The laminate of a nonwoven fabric and at least one textile may be prepared by placing the nonwoven fabric and said at least one textile in order into a mold heated at a temperature ranging from 120 to 170℃, and then applying a pressure of 5 to 7 kgf/cm^2 thereto for 6 to 10 hrs. The respective nonwoven fabric and textile may be pre-cut in the form of a disk.

The textile may be made of fibers impregnation-treated with a phenol resin, an acrylonitrile-butadiene-rubber latex or a mixture thereof. Preferably, the carbon fiber and glass fiber textiles are made of fibers impregnation-treated with a phenol resin, and the polyester and nylon textiles are made of fibers impregnation-treated with a mixture of a phenol resin and an acrylonitrile-butadiene-rubber latex, e.g., fibers obtained by impregnating polyester or nylon with a mixture of 70 to 90 weight% of a phenol resin and 10 to 30 weight% of an acrylonitrile-butadiene-rubber latex, and drying the impregnated polyester or nylon.

The carbon fiber textile and the reticular glass fiber textile are made of 48~70s/yarn ×25~30s/yarn (Warp×Fill) and 5~16s/yarn ×5~16s/yarn

(Warp×Fill) fibers, respectively. In addition, the polyester and nylon textiles are both made of 5~16s/yarn ×5~16s/yarn (Warp×Fill) fibers.

Engineering plastics and bakelite plates may be prepared by conventional methods known in the art.

The supporting substrate has a thickness ranging from 1.0 to 1.5mm. In case of employing a laminate of nonwoven fabric and textile layers, it is preferred that the nonwoven fabric and textile layers have the respective thickness of 0.1 to 0.3mm and 0.9 to 1.2mm.

The coated abrasive disk in accordance with the present invention is manufactured by coating an adhesive on a disk form of the supporting substrate (in case of employing a laminate of nonwoven fabric and textile layers, on the textile layer), adhering thereto a disk form of a coated abrasive body comprised of a backsheet and a layer of a coated abrasive material thereon, and aging at a temperature ranging from 20 to 40℃ for 1 to 2 days.

Suitable for the adhesive used for combining the supporting substrate and the coated abrasive body are epoxy resins, polyurethane resins, synthetic rubber and degenerated heat-curable resins.

The coated abrasive body which may be employed in the present invention is prepared by a method described below. First, a backsheet may be prepared by coating an adhesive, e.g., a phenol resin, an acrylonitrile-butadiene-rubber latex and a mixture thereof, on both sides of a material selected from the group consisting of polyester textile, cotton textile, polyester/cotton mixed textile (e.g., polyester yarn:cotton yarn=65:35, 50:50), polyester/nylon mixed textile (e.g., polyester yarn:nylon=50:50), polyester film (PET film) and cylinder paper. Then, a coated abrasive body may be prepared by coating a first adhesive mixture on the prepared backsheet, spreading an abrasive material thereon, drying at a temperature ranging from

60 to 110℃ for 1 to 3 hrs, coating and drying a second adhesive mixture thereon at a temperature ranging from 70 to 120℃ for 150 to 240 min to form a second adhesive layer, and cutting the coated abrasive body in a desired disk form.

The first and second adhesive mixtures are mixtures of an adhesive and a filler having a weight mix ratio of 50:50 and 40:60, respectively, and may be coated by a conventional method and, if necessary, roll-coated. The adhesive may be a conventional adhesive such as a phenol resin; and a conventional inorganic filler such as $CaCO_3$ may be employed.

Representative abrasive materials which may be employed in the present invention include alumina (Al_2O_3), silicon carbide (SiC), alumina zirconia (AZ), ceramics, diamond, CBN (cubic boron nitrile) and a mixture thereof. Such an abrasive material preferably has a particle size of 16 to 180 mesh and may be dispersed on the first adhesive layer by a conventional electric or dropping coating method.

The inventive abrasive disk may be made in a commercially desirable disk form, e.g., 4", 4+1/2", 5" and 7".

The following Examples and Comparative Example are given for the purpose of illustration only, and are not intended to limit the scope of the invention.

Example 1

Cut into a disk form having an outer diameter of 180mm and an inner diameter of 23mm were a 20 to 30 g/m^2 nonwoven fabric(polyester nonfabric commercially available from Kolon); two carbon fiber textiles (commercially available from Korea Fiber Company) composed of 58s/yarn ×30s/yarn (Warp×Fill) fibers impregnation-treated with Novolak phenol

resin; and two reticular glass fiber textiles (commercially available from Korea Fiber Company) composed of 8s/yarn ×8s/yarn (Warp×Fill) fibers impregnation-treated with Novolak phenol resin. The nonwoven fabric, carbon fiber textile and glass fiber textile disks were sequentially stacked from the bottom in a mold heated to 150℃, while a steel holder for fixing a disk to a tool was inserted within the inner diameter, and pressed at a force of 6.0 kgf/cm^2, to prepare a supporting substrate.

Then, a backsheet was prepared by processing a polyester film (PET film) and coating a phenol resin adhesive compounded with rubber on the both sides thereof. On the backsheet, a 50:50 (weight ratio) mixture of a phenol resin and $CaCO_3$ was coated in an amount of 250 g/m^2, alumina particles having a particle size of 24 mesh were spread in an amount of 900 g/m^2, and dried at a temperature of 90 to 95℃ for 2 hrs to form a first adhesive layer having the abrasive material dispersed therein. A 40:60 (weight ratio) mixture of a phenol resin and $CaCO_3$ was coated thereon in an amount of 500 g/m^2, and dried at a temperature of 90 to 95℃ for 4 hrs to form a second adhesive layer. The coating of the first and second adhesive layers was performed by a roll coater shown in FIG. 3.

The prepared coated abrasive body was cut into a disk form having an outer diameter of 180mm and an inner diameter of 23mm. A polyurethane resin having a molecular weight of 15,000 to 20,000 and a viscosity of 3,000 to 5,000 cps was coated in an amount of 90 to 125 g/m^2 on the glass fiber textile layer surface of the substrate, left for 5 min, and the substrate was combined with the backsheet of the cut coated abrasive body. The combined unit was aged and hardened at a room temperature for 2 days to thereby yield the coated abrasive disk in accordance with the present invention. No separate post-treatment of humidification was performed.

A longitudinal cross-sectional view of the textile layer, a laminate of two carbon fiber textiles and two glass fiber textiles is shown in FIG. 4.

Example 2

Cut into a disk form having an outer diameter of 180mm and an inner diameter of 23mm were a 20 to 30 g/m^2 nonwoven fabric(polyester nonfabric commercially available from Kolon) and five carbon fiber textiles (commercially available from Korea Fiber Company) composed of 48s/yarn ×25s/yarn (Warp×Fill) fibers impregnation-treated with Novolak phenol resin. The nonwoven fabric and carbon fiber textile disks were sequentially stacked from the bottom into a mold heated to 150℃, while a steel holder for fixing a disk to a tool was inserted within the inner diameter, and pressed at a force of 6.0 kgf/cm^2, to prepare a supporting substrate. Thereafter, the procedure of Example 1 was repeated to prepare the inventive coated abrasive disk.

Example 3

Cut into a disk form having an outer diameter of 180mm and an inner diameter of 23mm were a 20 to 30 g/m^2 nonwoven fabric(polyester nonfabric commercially available from Kolon) and six reticular glass fiber textiles (commercially available from Korea Fiber Company) composed of 10s/yarn ×10s/yarn (Warp×Fill) fibers impregnation-treated with Novolak phenol resin. The nonwoven fabric and glass fiber textile disks were sequentially stacked from the bottom into a mold heated to 150℃, while a steel holder for fixing a disk to a tool was inserted within the inner diameter, and pressed at a force of 6.0 kgf/cm^2, to prepare a supporting substrate. Thereafter, the procedure of Example 1 was repeated to prepare the inventive

coated abrasive disk.

Example 4

A 1.5mm thick injection-molded engineering plastic (Type LUPOS GP-2200H, commercially available from LG Chem.) was cut into a disk form having an outer diameter of 180mm and an inner diameter of 23mm, which was used as a supporting substrate. Thereafter, the procedure of Example 1 was repeated to prepare the inventive coated abrasive disk.

Example 5

A 1.5mm thick bakelite plate (commercially available from Korea Fiber Company) was cut into a disk form having an outer diameter of 180mm and an inner diameter of 23mm, which was used as a supporting substrate. Thereafter, the procedure of Example 1 was repeated to prepare the inventive coated abrasive disk.

Comparative Example

A 0.85mm thick vulcanized fiber substrate (GBR 0.85mm, commercially available from Toyo Fiber Company, Japan) was cut into a disk form having an outer diameter of 180mm and an inner diameter of 23mm. A first adhesive layer having an abrasive material dispersed therein and a second adhesive layer were formed directly on the cut substrate in accordance with the same method as in Example 1. Then, water was spread on the substrate surface with a brush and left for 7 days within an aging room kept at a temperature ranging from 25 to 30℃ and a relative humidity ranging from 70 to 80%, to prepare the conventional coated abrasive disk.

Characteristics Test

The characteristics of the respective abrasive disks obtained in Examples 1 to 5 and Comparative Example were measured in terms of tensile strength, rotation breakage strength and flexibility, and the results are shown in Table 1.

Table 1

	Coated Abrasive Disk					
	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Comp.Ex.
Tensile Strength (kgf/in)*1	300~ 350	350~ 400	250~ 300	150~ 200	200~ 250	150~ 200
Rotation Breakage Strength (min)*2	≥3	≥3	≥2.5	≥2	≥2	≥1.5
Flexibility*3	5	4	6	8	9	5

Note:
*1 : Tensile strength-measuring instrument – LLOYD Instruments type LR5R
*2 : 30,000 rpm
*3 : Pliableness ←----------I----------→ Stiffness
1 5 10

As can be seen from Table 1, the inventive abrasive disks of Examples 1 to 5 exhibit higher tensile strength and rotation breakage strength as compared to the conventional abrasive disk of Comparative Example. Further, the results demonstrate that the inventive abrasive disks can be advantageously employed in various fields due to their various flexibilities.

As described above, the present invention provides a simple and economical method for preparing without a humidification treatment a coated abrasive disk having an improved dimensional stability, high elasticity, high breaking strength, and high resistance against breakage by load or rapid rotation during the course of usage, which is useful for various applications including removal of rust from a ship steel, grinding of metal welding sites and removal of old car paint.

While the invention has been described with respect to the above

specific embodiments, it should be recognized that various modifications and changes may be made to the invention by those skilled in the art which also fall within the scope of the invention as defined by the appended claims.